

Oil Price, Exchange Rate, Interest Rate, and Market Return Relationships with Industries Stock Returns: Evidence from Iranian Stock Exchange

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Abstract

Systematic risk factors or market changes and fluctuations have chain effect on real economic activities and they are very important devices to explain stock price and return changes; hence this study examines the impact of market return, oil price, exchange rate and interest rate changes on stock returns of 36 industry sectors in Tehran Stock Exchange (TSE) using monthly data during the period of November 22, 2003 to November 20, 2008. In this paper, the multivariate regression model was used to study the relationship among market return, oil price, exchange rate and interest rate to stock return of each industry and method of autoregressive distributed lag (ARDL) is employed to test the model. Findings indicate that market return, oil price, exchange rate and interest rate changes have significant impacts on some industries returns while some have obtained contrary results.

Keywords

Market Return; Oil Price; Exchange Rate; Interest Rate; Stock Return of Each Industry

Introduction

An efficient capital market is one in which security prices adjust rapidly to the arrival of new information and, therefore, the current prices of securities reflect all information about the security. What this means, in simple terms, is that no investor should be able to employ readily available information in order to predict stock price movements quickly enough so as to make a profit through trading shares.

Economic theory suggests that stock prices should reflect expectations about future corporate performance, and corporate profits generally reflect the level of economic activities. If stock prices accurately reflect the

underlying fundamentals, then the stock prices should be employed as leading indicators of future economic activities, and not the other way around. Therefore, the causal relations and dynamic interactions among macroeconomic variables and stock prices are important in the formulation of the nation's macroeconomic policy (Abdol Rahman, et al, 2009; Achsani and Strohe, 2002, Al Sharkas, 2004, Anokye, 2008).

This paper investigates the role of macroeconomic factors in explaining stock return of each industry in Tehran Stock Exchange by covering time period spans from November 22, 2003 to November 30, 2008. This study employs some important macroeconomic factors including market return, oil price, exchange rate and interest rate.

The rest of the paper is organized as follows. Section 2 is about literature. Section 3 explains the data and the methodology, respectively. Section 4 provides analysis and results. Finally, section 5 presents the conclusions.

The Literature

Theoretical Framework

Pricing common stocks has been a great concern in the finance literature. Building on Markowitz' (1959) mean variance portfolio model, Sharpe (1964), Lintner (1965) introduced the first and generally accepted asset pricing theory, commonly called Capital Asset Pricing Model (CAPM). CAPM uses just one factor, namely stock market index, in order to explain common stock returns. Yet, the basic version of CAPM has some

restrictive assumptions each of which was exposed to intense criticisms, which initiated improvements in the model by introducing new versions of CAPM. An important criticism was about the unique role of the market in the model. As a result of adding extra variables to the model, multifactor models emerged. Merton (1973) pioneered these studies. Although their studies made contribution to asset pricing theories, market was again the main pricing variable in their models beside the other variables employed. Shortly after acknowledgement of factors in asset returns other than the market, the Arbitrage Pricing Theory (APT) was introduced to comprise the fore-mentioned but not employed factors (Ross, 1976). By employing statistical tools like factor analysis, APT initiated the use of variables without the need of pre specification of variables. But it did not take too long before the criticisms to appear. One major criticism was that APT could not specify the factors, but just derive them statistically. This inadequacy of the APT was accepted even in the first empirical APT study (Roll and Ross, 1980). They maintained that the factors derived by factor analysis should be fundamental economic aggregates, such as GNP or interest rates. Furthermore, they acknowledged that the APT could not specify these economic factors, and suggested investigation of economic factors that are peroxide by derived factors in the APT (Roll and Ross, 1980, p.1077).

Chen, Roll and Ross (1986), the first to employ specific macroeconomic factors as proxies for undefined variables in the APT, attempted to express the equity returns as a function of macroeconomic variables. Henceforth, this new model will be referred to as "Macroeconomic Factor Model" and abbreviated as "MFM". Since economic forces influence expected dividends and the discount rate, it is concluded that stock prices hence stock returns are systematically affected by economic variables. The discount rate is expected to change with the level of interest rates, term-structure and risk premium. Expected dividends may change because of inflation rate, real production, oil prices and consumption. The new model has an explicit advantage over the APT: Macroeconomic factors in the MFM can be given economic interpretation; whereas interpretation of the derived factors in the APT is not so simple. Nonetheless, the new model has its own disadvantage that is there has no theoretical framework for the selection of macroeconomic variables.

Due to known weaknesses in the CAPM model and also APT weaknesses in the economic interpretation of factors, studies began to identify macroeconomic variables effective on stock returns.

Empirical Studies

Faff and Brailsford (1999) investigated the sensitivity of Australian industry equity returns to an oil price factor using monthly return data over the period July 1983-March 1996 and employed an augmented market model with oil price, and they found significant positive oil price sensitivity in the oil and gas, and diversified resources industries. However, other industries such as paper and packaging, banks and transportation seem to exhibit negative sensitivity to oil price hikes.

Sadorsky (2001) employed multifactor model to evaluate the impact of oil price changes, exchange rate and interest rate (term premium) on stock returns of oil and gas companies in Canada. Using monthly data over the period 1983-1999, it is found that the changes in crude oil price have positive effect on stock returns of oil and gas companies, while depreciation of Canadian dollar to US dollar and increasing interest rate have negative effects on stock returns of those companies.

Park (2007) examined the relationship between oil price shocks and stock markets in the US and 13 European countries using monthly data during the period 1986-2005. This study uses an Unrestricted Multivariate VAR, and finds that oil prices play a crucial role in the stock markets of oil importing countries. In most oil importing countries, oil price shocks have a greater impact than interest rate shocks. On the contrary, in oil exporting countries, oil price shocks have a less significant impact on the stock markets than interest rate shocks do.

McSweeney and Worthington (2007) surveyed the relationship among portfolio market, oil price, exchange rate, interest rate to stock returns in nine industrial sectors in Australia, using monthly data over the period 1980-2006. Results showed that, there is significant correlation between market return and stock returns in each nine industrial sectors. Also the results indicate that oil prices are an important determinant of returns in the banking, energy, materials, retailing and transportation industries. In this paper, also there is a

significant relationship between exchange rate and stock returns in banking and financial industries, and between interest rate and stock returns in the energy, insurance, retail and transportation industries.

Gasman and Derivation (2008) examined the correlation between market return and exchange rate with stock returns in the nine industrial sectors in Indonesia by using monthly data during 1996-2008. Results indicated that significant relationship is between market return and stock return in nine industries. Also the significant relationship is among exchange rate and stock return Financial, Infrastructure, Miscellaneous, Mining, Property and Business industries. In this paper, oil price changes have not significant effects on stock returns of any sectors. This may indicate that decreasing oil price does not always bring good news to investors.

Brigit (2009) surveyed relationship among market return and exchange rate and oil price to stock return in sixteen industrial sectors in Turkey, using daily data over the period 2000-2008. The results showed that, there is significant relationship among market return and any the sixteen industry stock returns, and there is not significant relationship between exchange rates and stock returns in sixteen industries. Also, it is found that oil price changes have a significant positive effect on Wood, Paper and Printing, Insurance and Electricity industries.

Amihud (1993) studied the relationship between exchange rates and stock prices.

Data and Methodology

This study employs monthly data during the period November 22, 2003 to November 20, 2008, and it uses time series multifactor regression model estimated by method of autoregressive distributed lag (ARDL) for each stock return of the 36 industrial sectors in Iran.

To explain the macroeconomic variable on stock returns for each industry, the market model was used. Market model was extended by added oil price, exchange rate and interest rate. In this study, the model of Faft & Brailsford's (1999) was used. Following Faff and Brailsford, we employ a multifactor model:

$$R_{it} = \alpha_{i0} + \alpha_{i1}MKT_t + \alpha_{i2}OIL_t + \alpha_{i3}FX_t + \alpha_{i4}TRM_t + \varepsilon_{it} \quad (1)$$

Where, independent variables are market return (MKT_t), oil price (OIL_t), exchange rate (FX_t) and interest rate (TRM_t) and the dependent variable is industrial stock returns (R_{it}).

Market return is a proxy of changes in aggregate economic wealth which affects risk premium and expected returns of the stocks (Sadorsky, 2001). Here, market return is calculated as:

$$MKT_t = \frac{\sum_{i=1}^n p_{it}q_{it}}{RD_t} \times 100 \quad (2)$$

Where:

p_{it} = The price of company i at time t

q_{it} = The number of published stock of company i at time t

RD_t = The base of price and cash return index at time t when in the beginning time has been $\sum p_{i0}q_{i0}$.

Adjustment of base MKT_t index is by the following formula:

$$RD_{t+1} = \frac{\sum_{i=1}^n p_{it}q_{it} - \sum_{i=1}^n DPS_{it+1}}{\sum_{i=1}^n p_{it}q_{it}} \times RD_t + \frac{RD_t}{D_t} \times (D_{t+1} - D_t) \quad (3)$$

Where:

RD_{t+1} = The base of price and cash return index at time $t+1$ (after Adjustment)

RD_t = The base of price and cash return index at time t (before Adjustment)

p_{it} = The price of company i at time t

q_{it} = The number of published stock of company i at time t

DPS_{it+1} = Dividends paid by company i at time $t+1$

D_{t+1} = The base of total price index at time $t+1$ (after Adjustment)

D_t = The base of total price index at time t (before Adjustment)

Market return data are acquired from the Tehran stock exchange of Iran. Oil price movements have the potential to influence equity price returns through their impact on future cash flows. OPEC basket price is employed as a proxy for oil price as monthly. Exchange rate is a proxy for foreign exchange risk. Exchange rate volatility is one factor that affects stock price, particularly for domestic industries with trading activities involving contracts in US dollar denomination. To calculate monthly exchange rate, we used exchange rate of IRR/USD that used data are acquired from the central bank of Iran.

To calculate the interest rate, the Fisher's formula is utilized and calculated as:

$$r = I - \pi \quad (4)$$

Where:

r = Real interest rate

I = Nominal interest rate

Nominal interest rate=Term investment deposit rates for one-year divided by twelve. Term Investment deposit rates data for one-year is acquired from the Central Bank of Iran.

π = Inflation rate

Inflation rate data are acquired from the central bank of

Iran. To calculate stock return of each industry used from price and cash return index formula (formula (2)), information about companies of each industry is placed in the formula. Stock return data of each industry is acquired from the Tehran stock exchange of Iran.

Analysis and Results

The assumption tests for stationary (unit root test Augmented Dickey-Fuller - ADF) suggest that some variables in $I(0)$ and some variables in $I(1)$ are stationer. Hence, we estimated with Auto Regressive Distributed Lag (ARDL) method. (ARDL) regression results are presented in Table 1.

TABLE 1: REGRESSION RESULTS THE IMPACT OF OIL PRICE CHANGES ON INDUSTRIAL STOCK RETURNS

Dependent variables	independent variables			
	Market Return	Oil price	Exchange rate	Interest rate
Metal Minerals industry	0.581 0.000*	-51.459 0.030**	0.099 0.519	206.464 0.216
Other mines industry	0.015 0.375	-4.207 0.249	0.015 0.797	114.888 0.087***
Textiles industry	0.098 0.266	0.024 0.32	-0.08 0.029**	-1.082 0.189
Leather products industry	0.0004 0.835	-0.261 0.537	0.003 0.662	10.325 0.203
Wood Products industry	0.022 0.163	-5.446 0.050**	-1.474 0.047**	-132.754 0.007*
Paper products industry	-0.0007 0.923	0.7 0.777	0.035 0.167	-52.563 0.133
Publishing and printing industry	0.203 0.106	-13.144 0.222	0.522 0.003*	-261.769 0.178
Oil products industry	0.331 0.004*	-78.001 0.002*	0.137 0.334	-1.431 0.993
Rubber industry	0.077 0.005*	-5.692 0.014**	0.063 0.059***	-11.362 0.794
Basic metals industry	0.925 0.000*	-6.258 0.669	-0.001 0.997	798.556 0.000*
Devices Communication industry	-0.004 0.181	-0.853 0.215	0.057 0.002*	16.934 0.227
Medical devices industry	-0.004 0.702	16.672 0.007*	1.832 0.004*	-48.005 0.181
Vehicle industry	0.217 0.010*	7.661 0.172	5.751 0.001*	-238.517 0.024**
Sugar industry	-0.018 0.006*	-6.265 0.027**	0.068 0.002*	-3.97 0.851
industrial Multidisciplinary industry	0.61 0.000*	-25.129 0.001*	-0.046 0.609	140.565 0.255
Food except sugar industry	0.1 0.001*	-4.042 0.274	1.443 0.029**	-113.145 0.010*
Pharmaceutical substances industry	-0.019 0.471	6.388 0.281	0.061 0.37	45.112 0.656
Chemical industry	0.318 0.000*	-1.079 0.859	0.019 0.819	-106.61 0.326
Contractor industry	1.397 0.000*	-120.375 0.008*	0.992 0.041**	-754.814 0.155
Tile and Ceramic industry	0.03 0.002*	3.064 0.138	-0.632 0.184	-21.784 0.489

Dependent variables	independent variables			
	Market Return	Oil price	Exchange rate	Interest rate
Cement industry	0.945 0.001*	-64.683 0.049**	0.484 0.228	-315.733 0.443
Investments industry	0.277 0.000*	-15.429 0.000*	0.012 0.8	-110.847 0.080***
Non-metal minerals industry	0.036 0.003*	-2.096 0.048**	0.023 0.224	0.069 0.997
Computer industry	0.009 0.206	2.705 0.065***	0.064 0.005*	-13.122 0.639
Machinery industry	0.023 0.005*	-5.135 0.049**	0.023 0.107	-18.851 0.312
Metal products industry	0.029 0.052***	-2.246 0.128	0.054 0.005*	-33.429 0.112
Electrical devices industry	0.029 0.013**	-8.434 0.001*	-1.51 0.013**	77.283 0.065***
making Mass industry	0.436 0.002*	-17.46 0.087***	-0.032 0.812	12.36 0.948
Agriculture industry	0.008 0.172	0.875 0.655	-0.933 0.012**	14.712 0.52
Other transportation devices industry	-0.001 0.775	-0.036 0.961	0.018 0.154	1.668 0.898
Furniture industry	-0.078 0.437	-92.962 0.061***	0.19 0.513	-48.158 0.899
Banks industry	0.143 0.000*	-7.855 0.005*	-0.298 0.000*	53.903 0.33
Coal industry	0.061 0.003*	-8.315 0.100***	-0.004 0.856	59.637 0.062***
Transport industry	0.065 0.000*	-16.563 0.014**	-0.186 0.000*	78.914 0.096***
Technical and Engineering industry	0.043 0.050**	-4.135 0.065***	0.037 0.078***	-50.823 0.107
Other financial intermediation industry	0.069 0.000*	-1.205 0.763	-0.111 0.036**	143.257 0.073***

According to the results of analysis of model, market return changes have statistically significant effects on Metal Minerals, Oil Products, Rubber, Basic Metals, Vehicle, Sugar, Industrial Multidisciplinary, Food except Sugar, Chemical, Contractor, Tile and Ceramic, Cement, Investments, Non-metal Minerals, Machinery, Making Mass, Banks, Coal, Transport and Other Financial Intermediation Industries at the 1% significance level, as well as on Electrical Devices and Technical and Engineering Industries at the 5% significance level, and Metal Products industry at the 10% significant level. On the other hand, market return changes have not any statistically significant affect on Publishing and Printing, Textile, Leather Products, Wood Products, Paper Products, Other Mines, Devices Communication, Medical Devices, Pharmaceutical Substances, Computer, Furniture, Other Transportation Devices and Agriculture Industries. It is expected that market return changes have statistically significant positive effects on total industries. The coefficient of Sugar Industry should be positive and statistically significant, and it is expected that market return increasing has positively affected the Sugar Industry

return.

According to the results of analysis of model, oil price changes have statistically significant effects on Oil Products, Medical Devices, Industrial Multidisciplinary, Contractor, Investments, Electrical Devices and Banks Industries at the 1% significance level, as well as on Metal Minerals, Wood Products, Rubber, Sugar, Cement, Non-metal Minerals, Machinery and Transport Industries at the 5% significance level. In addition, oil price changes has statistically significant effects on Computer, Making Mass, Furniture, Coal and Technical and Engineering Industries at the 10% significant level. On the other hand, market return changes have not any statistically significant affect on Other Mines, Textiles, Leather products, Paper Products, Publishing and Printing, Basic Metals, Devices Communication, Vehicle, Food except Sugar, Pharmaceutical Substances, Chemical, Tile and Ceramic, Metal Products, Agriculture, Other Transportation Devices and Other Financial Intermediation Industries. It is expected that oil price changes have statistically significant positive effects on

Oil Products Industry.

In Table 1, *, **, and *** indicate confidence level 99%, 95%, and 90%, respectively.

According to the results of analysis of model, exchange rate changes have statistically significant effects on Publishing and Printing, Devices Communication, Medical Devices Industry, Vehicle, Sugar, Computer, Metal Products Industry, Banks and Transport Industries at the 1% significance level as well as on Textiles, Wood Products, Food except Sugar, Contractor, Electrical Devices, Agriculture and Other Financial Intermediation Industries at the 5% significance level, in addition to this, on Rubber and Technical and Engineering Industries at the 10% significant level.

On the other hand, exchange rate changes have not any statistically significant affect on Metal Minerals, Other Mines, Leather Products, Paper Products, Oil Products, Basic Metals, Industrial Multidisciplinary, Pharmaceutical Substances, Chemical, Tile and Ceramic, Cement, Investments, Non-metal Minerals, Machinery, Making Mass, Other Transportation Devices, Furniture and Coal Industries.

According to the results of analysis of model, interest rate changes have statistically significant effects on Wood Products, Basic Metals and Food except Sugar Industries at the 1% significance level as well as on Vehicle Industry at the 5% significance level, in addition to this, on Other Mines, Investments, Electrical Devices, Coal, Transport and Other Financial Intermediation Industries at the 10% significant level. On the other hand, interest rate changes have not any statistically significant affect on Metal Minerals, Textiles, Leather Products, Paper Products, Publishing and Printing, Oil Products, Rubber, Devices Communication, Medical Devices, Sugar, Industrial Multidisciplinary, Pharmaceutical Substances, Chemical, Contractor, Tile and Ceramic, Cement, Non-metal Minerals, Computer, Machinery, Metal Products, Making Mass, Agriculture, Other Transportation Devices, Furniture, Banks Industry and Technical and Engineering Industries. It is expected that interest rate changes have statistically significant effects on Banks Industry.

Conclusions and Final Remarks

This paper examines the impact of market return, oil price, exchange rate and interest rate changes on stock returns of Thirty six industry sectors in Iran using monthly data during the period November 22, 2003 to

November 20, 2008. In this paper, time-series regression model was used to determine the effects of market return, oil price, exchange rate and interest rate changes on stock return of each industry in Tehran Stock Exchange.

Results of the test of the models showed that market return changes have statistically significant positive effects on Metal Minerals, Oil products, Rubber, Basic metals, Vehicle, Industrial Multidisciplinary, Food except Sugar, Chemical, Contractor, Tile and Ceramic, Cement, Investments, Non-metal Minerals, Machinery, Making Mass, Banks, Coal, Transport, Other Financial Intermediation, Electrical Devices, Technical and Engineering and Metal Products Industries as well as on Sugar Industry.

Results of the test of the models showed that oil price changes have statistically significant positive effects on Medical Devices and Computer Industries, however, it has negative effects on Metal Minerals, Wood Products, Oil Products, Rubber, Medical Devices, Sugar, Industrial Multidisciplinary, Contractor, Cement, Investments, Non-metal Minerals, Computer, Machinery, Electrical Devices, Making Mass, Furniture, Banks, Coal, Transport, Technical and Engineering Industries.

Results of the test of the models showed that exchange rate changes have statistically significant positive effects on Publishing and Printing, Rubber, Devices Communication, Medical Devices, Vehicle, Sugar, Food except Sugar, Contractor, Computer, Metal Products and Technical and Engineering Industries as well as on Textiles, Wood Products, Electrical Devices, Agriculture, Banks, Transport and Other Financial Intermediation Industries.

Results of the test of the models showed that interest rate changes have statistically significant positive effects on Other Mines, Basic Metals, Electrical Devices, Coal, Transport and Other Financial Intermediation Industries, while have statistically significant negative effects on Wood Products, Vehicle, Food except Sugar and Investments Industries.

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